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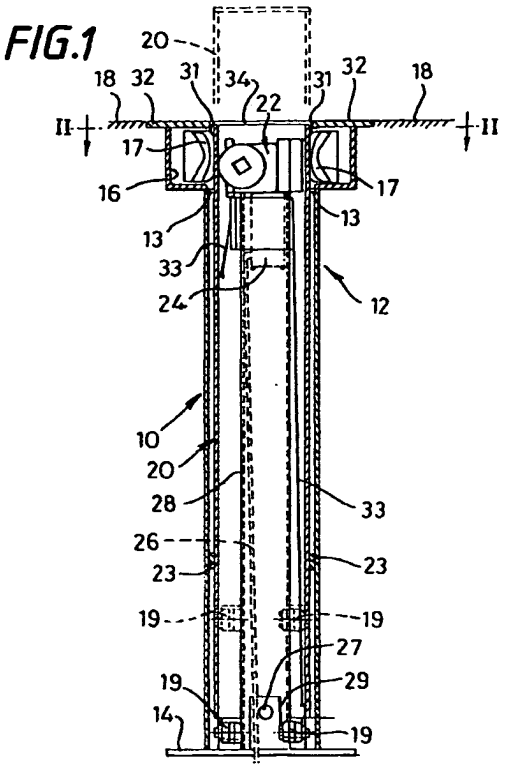
(54) Retractable barriers

(57) A retractable throughway barrier (10) comprising a casing (12) to be embedded in the ground, and a hollow bollard (20) to be expelled outwardly of or retracted inwardly of the casing (12). The hollow bollard (20) is provided with a member (21) susceptible to magnetisation and provided with an upstanding surface. Guide means (15) are provided between the casing (12) and the bollard (20) to guide the bollard (20) during its aforesaid motions. Drive means (22) is provided within the hollow bollard (20) to move the bollard (20) as aforesaid, said drive means (22) including a magnetic body (45) magnetically coupled to the said member (21) and having a surface in rolling contact with said upstanding surface.

FIG.1



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Description

Technical Field

[0001] This invention relates to retractable barriers for roads, passages or other throughways.

Background

[0002] In general, conventional retractable barriers for throughways either have an hydraulic operating mechanism or an electro-mechanical operating mechanism. Hydraulic operating mechanisms are usually bulky, expensive, noisy in operation and have a tendency to leakage of the hydraulic fluid - which may have undesirable consequences. Electro-mechanical operating mechanisms are usually screwdriven, have no mechanical clutch, are cumbersome to operate and fail adequately to seal working parts against moisture ingress.

[0003] A retractable road barrier proposed in GB-1275559 comprises one or more vertically slidable members actuated by one or more linear electric motors. Such linear electric motors are expensive to install and their use in such apparatus gives rise to many practical difficulties, e.g. as sideways movement causes variations in the magnetic flux and hence in the transmitted power and/or if the vertical movement imparted by the linear motor is physically resisted thereby potentially leading to motor burn out.

Summary of the Invention

[0004] With a view to overcoming or at least minimising one or more of the above mentioned and/or other disadvantages of the prior retractable throughway barriers, the present invention contemplates the provision of a retractable throughway barrier comprising a casing to be embedded in the ground, a hollow bollard to be expelled outwardly of or retracted inwardly of the casing, said hollow bollard being provided with a member susceptible to magnetisation and provided with an upstanding surface; guide means between the casing and the bollard to guide the bollard during its aforesaid motions, and drive means within the hollow bollard to move the bollard as aforesaid, said drive means including a magnetic body magnetically coupled to the said member and having a surface in rolling contact with said upstanding surface.

[0005] Preferably the hollow bollard is of steel and has a rectangular, e.g. square, transverse cross-section. Advantageously one of the four walls of the hollow bollard defines the said member susceptible to magnetisation and its inner face defines said upstanding surface.

[0006] Advantageously said guide means are roller guide means, which preferably includes four rollers engaging the four corner edges of the hollow bollard.

[0007] Preferably the drive means comprises a motor unit rotatably driving said magnetic body which is cylindrical and

(a) has radial end walls at opposed ends of the body's outer cylindrical surface,
(b) is magnetically polarised axially of the cylindrical surface, and
(c) has a disc-like pole plate at each radial end of the cylindrical surface, the two disc-like pole plates having a like diameter greater than the diameter of the cylindrical surface.

[0008] Advantageously a counterweighting mechanism is provided between the drive means and the bollard, preferably located internally of the bollard.

Brief Description of the Drawings

[0009] By way of example one embodiment of this invention will now be described with reference to the accompanying drawings of which:

Figure 1 is a schematic vertical cross-sectional view of apparatus comprising a retractable throughway barrier according to the present invention,
Figure 2 is a cross-sectional view along the line II-II of Fig 1; and
Figure 3 is a schematic radial cross-section through part of a drive device shown in Fig 2.

Detailed Description of Example(s) of the Invention

[0010] The retractable throughway barrier 10 comprises a hollow steel casing 12 that is embedded in the ground. The casing 12 has an outwardly extending wider bottom flange 14 and an outwardly extending, wider upper chamber 16 the top of which is generally level with the top ground surface 18. The steel casing 12 is keyed into a concrete foundation that surrounds it which, by entering the space between flange 14 and chamber 16, provides for a locked-in arrangement.

[0011] The throughway barrier 10 further comprises a hollow steel bollard 20 that is to be expelled outwardly of casing 12 (as intimated by broken lines in Fig 1) or retracted inwardly of the casing 12 — as shown in full lines in Fig 1. The hollow steel bollard 20 has a rectangular, e.g. square, transverse cross-section and is driven outwards or inwards by drive means 22 engaging the inner face of one of the four walls (referenced 21) of the hollow bollard. In this example the wall 21 thus constitutes a member susceptible to magnetisation and its inner face defines an upstanding surface.

[0012] Guide means 15 are provided between the casing's upper chamber 16 and the bollard 20 to guide the bollard as it is expelled from or drawn into the casing 12. As best shown in Fig 2, the guide means 15 take the form of roller guide means which, in this example, comprise four upper rollers 17 of pulley-wheel shape, mount-

ed in chamber 16 and engaging the four corner edges of the square or rectangular hollow bollard 20. Further guide means comprise two pairs of rollers 19 mounted on depending flange-like extensions of the walls of the bollard 20 and engaging the walls of the casing 12.

[0013] Stop members 23 are mounted on the bollard 20 to extend laterally in opposite directions and by engagement of lateral inward extensions 13 of the casing 12 (at the base of chamber 16), jointly provide a limit to the upward extension of bollard 20. A lock 36 is also provided to lock the bollard 20 in either its fully raised or fully lowered position.

[0014] The drive means 22 is mounted at the top of a column 28 within the hollow bollard 20 and, as already stated, is to move the bollard selectively inwardly and outwardly of the casing 12. The drive means 22 comprises an electric, low voltage, high torque motor unit 24 — electrically supplied via an electric cable 26 — having an output shaft 47 connected to a non-circular (preferably square) cross-section adaptor 48 located in a bore 43 of like cross-section in a cylindrical magnetic body 45 which:

(a) has radial end walls 41,42 at opposed ends of the body's outer cylindrical surface,
(b) is magnetically polarised axially of the cylindrical surface, and
(c) has a disc-like pole plate 44,46 at each radial end 41,42 of the cylindrical surface, the two disc-like pole plates 44,46 having a like diameter greater than the diameter of the cylindrical surface of body 45.

[0015] The arrangement provides for the drive means' magnetic body 45 to be thus magnetically coupled to the wall 21 and have the disc-like pole-plates 44,46 in rolling contact with the wall's upstanding inner surface.

[0016] To improve this magnetic coupling and/or ensure that it is always provided to its greatest possible extent, the column 28 supporting the drive means 22 is provided with a degree of lateral flexibility. This is provided by a loose cotter-pin fixing of the column 28 to and between a pair of tabs 29 upstanding from base flange 14 and apertured at 27 to receive the cotter pin.

[0017] Optionally and preferably the axial adaptor 48 is a loose fit in the bore 43. For example, bore 43 is marginally greater — e.g. 1mm to 2mm (preferably 1.4mm) greater — than the side dimension of the axial adaptor 48 that transmits drive thereto and such as to permit the body to tilt or slew to a limited degree. For example, with the bore through body 45 and pole plates 44,46 of a square cross-section having a nominally 24mm side dimension the square-section axial adaptor 48 may have a side dimension of 22.6mm (⅞ inch) so as to pass loosely or with clearance into the bore 43. The clearance provided by this dimensional difference allows the end pole plates 44,46 in use to maintain physical contact with the wall 21 of the bollard 20 notwithstanding surface imperfections or variations in stiction between co-operating parts. This ability to cope with a slightly uneven running surface is assisted by permitting lateral movement of the column 28 with respect to wall 21 (by the cotter pin mounting at 27) and serves to maximise efficiency of the transmitted drive.

[0018] The two pole plates 44,46 are of substantially similar dimensions each having a periphery that, all round, is spaced outwardly away from the periphery of the magnetic body 45, e.g. of the order of 1 or 2mm (with a maximum of about 5mm). In one preferred embodiment the plates 44,46 are each 6mm thick and of 75mm nominal diameter.

[0019] The two pole plates 44,46 may be identical discs or as disclosed in UK Patent Application No. 0019719.4, or may provide for a degree of keyed or geared connection between one of the pole plates and the wall 21, this keying being surmountable without giving rise to damage.

[0020] A counterweighting mechanism 30 is provided between the drive means 22 and the bollard 20, this mechanism being located internally of the bollard. The mechanism 30 includes cables 33 attached to upper and lower hooks on the inner wall of bollard 20 and tensioned by the counterweighting mechanism 30..

[0021] The top of bollard 20 is provided by a cover plate 34 that is removable when it is necessary to access the apparatus' components internally of the bollard 20. A brush-type strip seal 31 is mounted about an aperture in a top plate 32, the bollard in use extending and retracting slidingly past this seal 31.

[0022] It will be appreciated that if movement of the bollard 20 is obstructed during its extension or retraction from or into the casing 12, then the magnetic flux "F" between the disc-like pole-plates 44,46 and the wall 21 will continue to act but the resultant transmitted drive effect will be overcome by the mechanical forces due to the obstruction. The discs 44,46 will continue to rotate but will slip with respect to wall 21 without causing damage to the electric motor supplying rotary power to the drive means 22.

[0023] The above-described and illustrated retractable bollard 20 can combine high operating speed at reasonable cost. It can be constructed to offer exceptional robustness, making it ideal for anti-ramraid and high security protection as well as for traffic control applications in vulnerable sites and be suitable for intensive industrial and commercial use. For example, the bollard 20 can be designed to rise and lower in 12 seconds through an operating height of 600mm. A manual over-ride facility may be included which allows the bollard 20 to be both raised and lowered with the appropriate security key actuating lock 36.

[0024] Although the electrical control for the motor and drive unit 22 locks the bollard into the "UP" position for maximum security, the apparatus is automatically provided with limited "slip" in action — if the bollard meets with an obstruction — due to the magnetic drive

transfer employed. This feature provides both internal protection for the mechanism and external safety for the user. The components can be automatically reset during the next operation, without need of user intervention.

[0025] It will be apparent that the motor and drive 22 are combined in one compact unit, which is sheltered in an air pocket within the bollard 20 and that no sealing is necessary and space is optimised.

[0026] Shock absorbing rubber adjuster blocks 50 are provided to enable the apparatus 10 to shrug off light impacts without damage. Also, by removing cover plate 34, the apparatus allows for manual release in case of power failure. Alternatively or additionally the apparatus may incorporate a power supply back-up and/or electronic systems to provide fail open, or fail secure or fail secure (i.e. closed) versions. The fail secure arrangement permits operation in the event of a power supply failure and in a manner such that security is not compromised. For this the lock 36 remains closed but can be released with a key.The fail safe arrangement provides that, in the event of a power supply failure, vehicles are not trapped within an enclosure closed by the retractable bollard but the latter can be lowered (retracted) and the system can be manually released (without a key). For this, the lock 36 releases if power is cut so that the bollard 20 can be forced down , i.e. retracted, against the the action of the magnetic drive means 22. It should be noted that such a fail safe operation is not possible with conventional electromechanical retractable bollards.

[0027] The illustrated apparatus 10 can provide a minimum maintenance, silent and virtually frictionless propulsion system that incorporates a smooth reliable mechanism in a highly compact form (so that the necessary depth of excavation is minimal). The magnetic drive transfer provided by drive means 22 is, in effect, a built-in, drive limiting, magnetic clutch that can ensure user safety and protection of the mechanism. Also, the design of apparatus 10 provides for a virtually infallible "air pocket" sealing system that can protect the motor and mechanism in the event of flooding.

[0028] Modifications of the above-described and illustrated apparatus can include one or more of the following:

- audible warning buzzer or flashing beacon, operable when the bollard 20 is being raised;
- high visibility reflective warning stickers, sign-written to E.U./N15 formats;
- power back-up for uninterrupted operation during a mains power failure;
- proximity card, radio control, token or push button console operation;
- infrared, induction and radar detectors for safety or opening on approach or exit of a road, passage or other throughway in which the bollard 20 is located;
- interface to new or existing voice communication, video or traffic control lights.

[0029] The aforesaid modifications as well as other modifications and embodiments of the invention, which will be readily apparent to those skilled in this art, are to be deemed within the ambit and scope of the invention, and the particular embodiment(s) hereinbefore described may be varied in construction and detail, e.g. interchanging (where appropriate or desired) different features of each, without departing from the scope of the patent monopoly hereby sought.

Claims

1. A retractable throughway barrier comprising a casing to be embedded in the ground, and a hollow bollard to be expelled outwardly of or retracted inwardly of the casing, **characterised in that**

   said hollow bollard is provided with a member susceptible to magnetisation and provided with an upstanding surface;
   guide means are provided between the casing and the bollard to guide the bollard during its aforesaid motions, and

   In that drive means is provided within the hollow bollard to move the bollard as aforesaid, said drive means including a magnetic body magnetically coupled to the said member and having a surface in rolling contact with said upstanding surface.

2. A retractable throughway barrier according to Claim 1, wherein the hollow bollard is of steel and has a rectangular, e.g. square, transverse cross-section.

3. A retractable throughway barrier according to Claim 2, wherein one of the four walls of the hollow bollard defines the said member susceptible to magnetisation and its inner face defines said upstanding surface.

4. A retractable throughway barrier according to any preceding Claim, wherein said guide means is provided by roller guide means.

5. A retractable throughway barrier according to Claim 4 when dependent from either Claim 2 or Claim 3, wherein roller guide means includes four rollers engaging the four corner edges of the hollow bollard.

6. A retractable throughway barrier according to any preceding Claim, wherein the drive means comprises a motor unit rotatably driving said magnetic body which is cylindrical and

   (a) has radial end walls at opposed ends of the body's outer cylindrical surface,
   (b) is magnetically polarised axially of the cylin-

drical surface, and
(c) has a disc-like pole plate at each radial end of the cylindrical surface, the two disc-like pole plates having a like diameter greater than the diameter of the cylindrical surface.

7. A retractable throughway barrier according to any preceding Claim, wherein a counterweighting mechanism is provided between the drive means and the bollard.

8. A retractable throughway barrier according to Claim 7, wherein the counterweighting mechanism is located internally of the bollard.

FIG.1

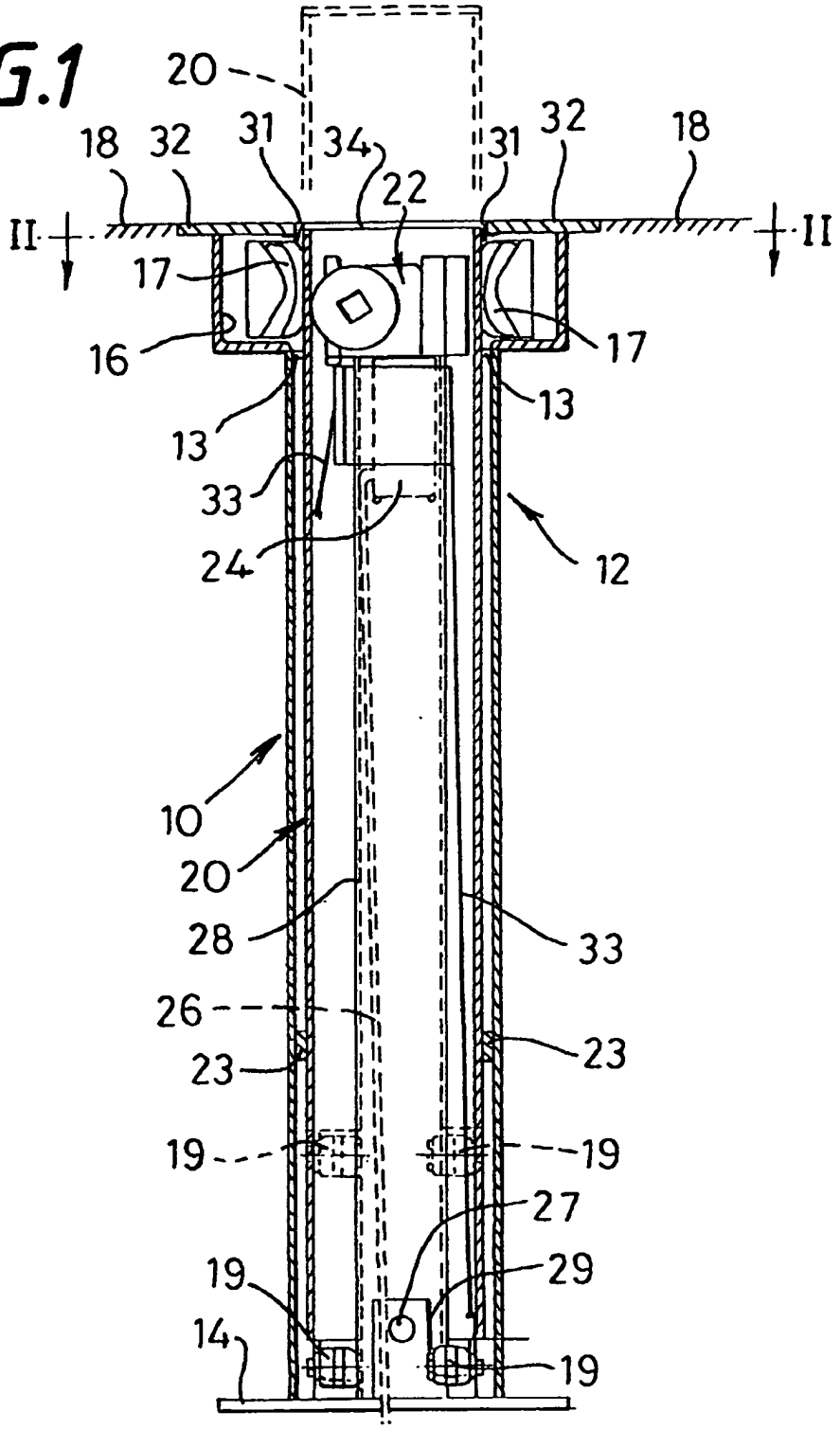
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FIG.2

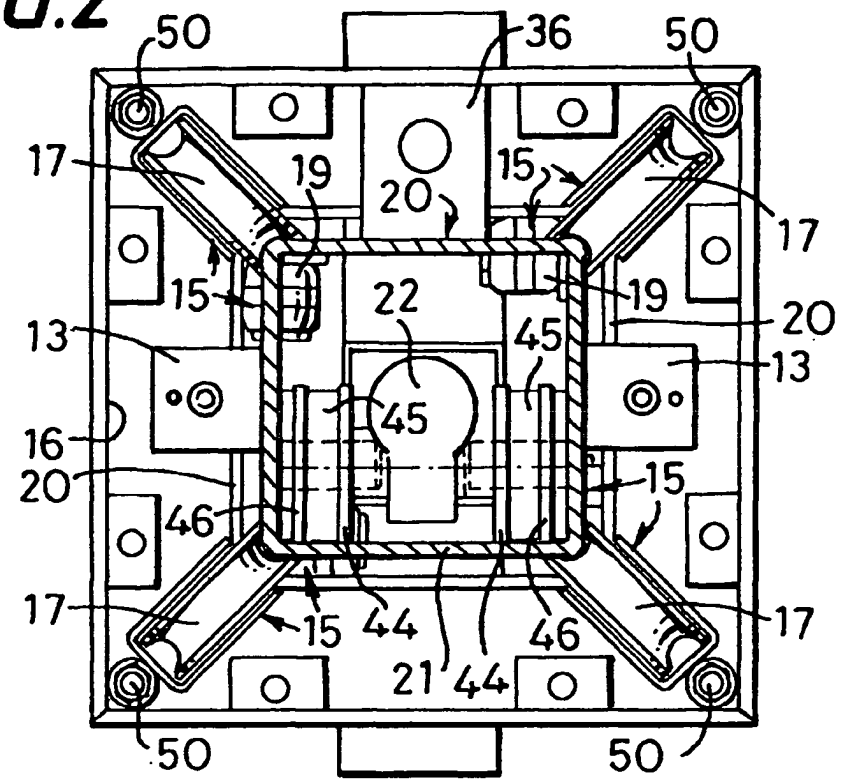
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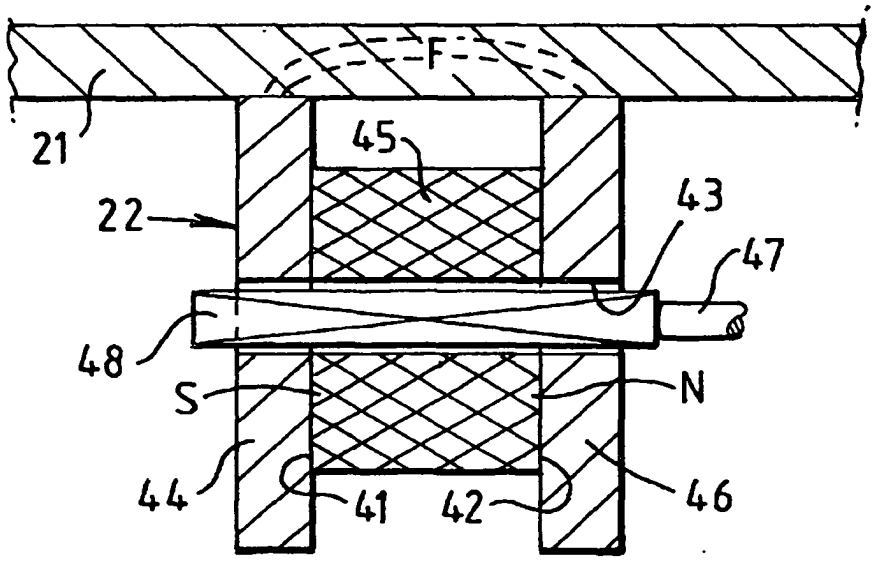
FIG.3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